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APX9132

Hall Effect Micro Switch IC

Features

- Micro Power Operation for Battery Applications
- Chopper Stabilized Amplifier
- Independent of North or South Pole Magnet, Easy for Manufacture
- Small Size Package
- Lead Free Available (RoHS Compliant)

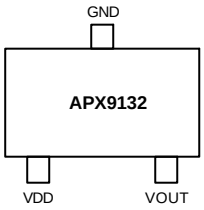
Applications

- Micro Switch
- Handheld Wireless Application Wake Up Switch
- Clamp Shell Type Application Switch
- Magnet Switch in Low Duty Cycle Applications

General Description

The APX9132 integrated circuit is an ultra-sensitive, pole independent Hall-effect switch with a latched digital output. A 2.5 volt to 3.5 volt operation and a unique clocking scheme reduce the average operating power requirements, Either a north or south pole of sufficient flux will turn the output on; in the absence of a magnetic field, the output is off. The polarity independence and minimal power requirement allow this device to be easily replaced reed switch for superior for signal conditioning. Advanced CMOS processing is used to take advantage of low-voltage and low-power requirements, SOT-23 package provided a optimized package for most applications.

Pin Description



SOT-23

Ordering Information

APX9132 □□-□□□ Lead Free Code Handling Code Temp. Range Package Code	Package Code A : SOT-23 AT : SOT-23 Thin Temp. Range I : -40 to 85° C Handling Code TR : Tape & Reel Lead Free Code L : Lead Free Device Blank : Original Device
APX9132 A/AT: X32X	X: Date Code

Notes: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte in plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldiering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

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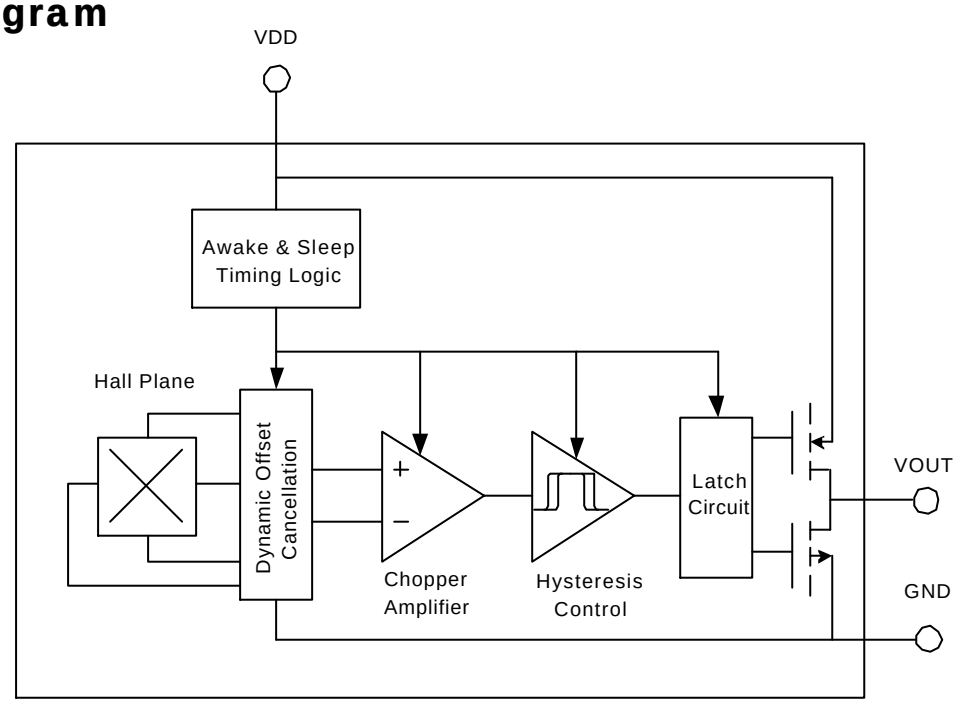
Rev. A.1 - Nov., 2005

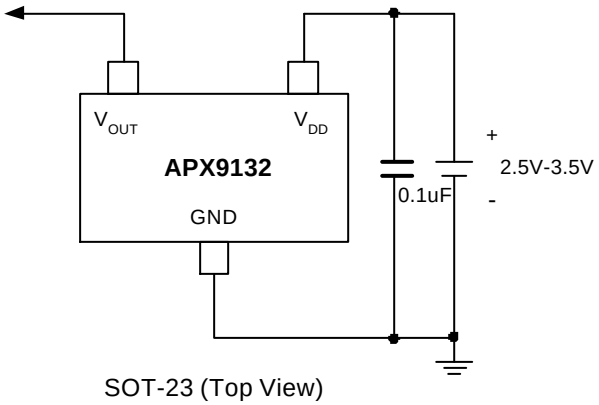
Function Pin Descriptions

No	Name	Function
1	V_{DD}	Power Input
2	V_{OUT}	When a magnetic field enters the hall element and exceeds the operate point B_{OPS} (or less than B_{OPN}) the output turns on (output is low). When the magnetic field is below the release point B_{RPS} (or above B_{RPN}), the output turns off (output is high).
3	GND	Ground Connection

Block Diagram



Typical Applications



SOT-23 (Top View)

Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	Rating	Unit
V_{DD}	Supply Voltage	5	V
V_{OUT}	Output Voltage	5	V
I_{OUT}	Output Current	±1	mA
T_J	Junction Temperature Range	150	°C
T_{STG}	Storage Temperature Range	-65 to +150	

Electrical Characteristics T_A = 25°C, V_{DD}=3V unless otherwise noted

Symbol	Characteristic	Test Condition	APX9132			Unit
			Min.	Typ.	Max.	
V_{DD}	Supply Voltage Range	Operating	2.5		3.5	V
I_{DD}	Supply Current	Average		5	10	µA
		Awake		1.2	2	mA
		Sleep		2	8	µA
I_{OFF}	Output Leakage Current	V_{OUT}=3.5V, B_{RPN}<B<B_{RPS}			1.0	µA
V_{OH}	Output High Voltage	I_{SINK}=-1mA	V_{DD} -0.4			V
V_{OL}	Output Low Voltage	I_{SINK}=1mA		20	40	mV
t_{awake}	Wake up Time			180		µs
t_{period}	Period			60		mS
d.c.	Duty Cycle			0.3		%
f_c	Chopping Frequency			11		KHz

Magnetic Characteristics T_A = 25°C, V_{DD}=3V unless otherwise noted

Symbol	Characteristic	Test Condition	APX9132			Unit
			Min.	Typ.	Max.	
B_{OPS}	Operate Points			30	45	G
B_{OPN}			-45	-30		G
B_{RPS}	Release Points		10	20		G
B_{RPN}				-20	-10	G
B_{hys}	Hysteresis			10		G

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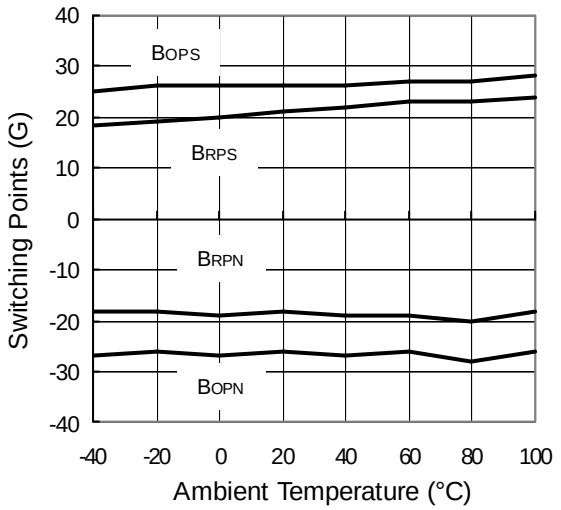
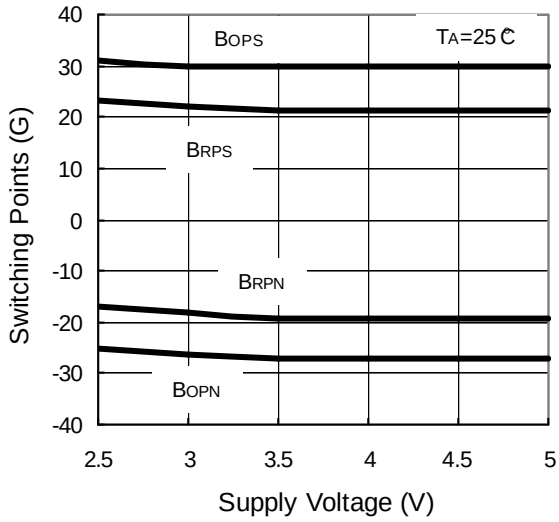
Typical Characteristics

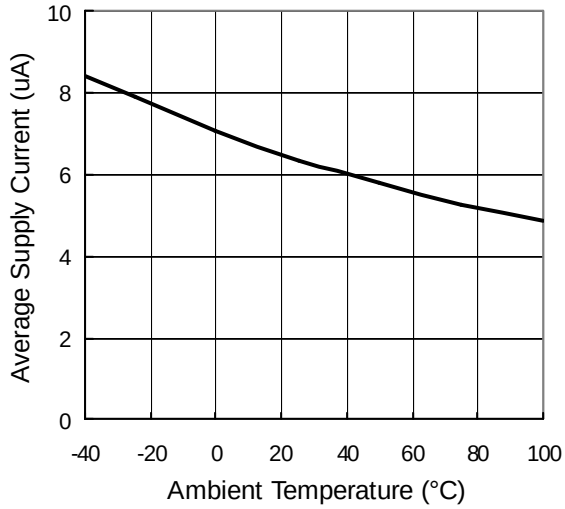
Switching Points vs. Ambient Temperature



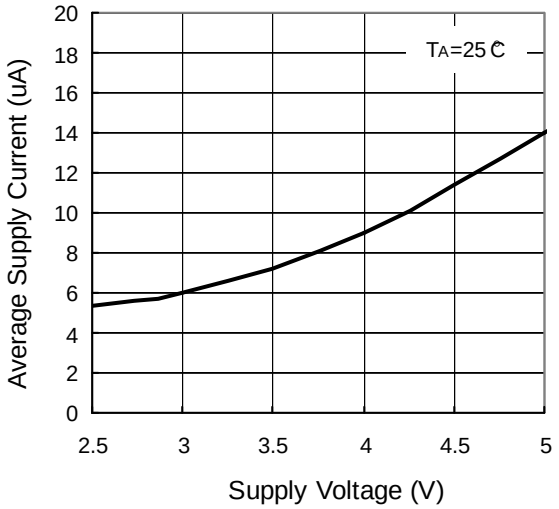
Switching Points vs. Supply Voltage



Average Supply Current vs. Ambient Temperature



Average Supply Current vs.Supply Voltage



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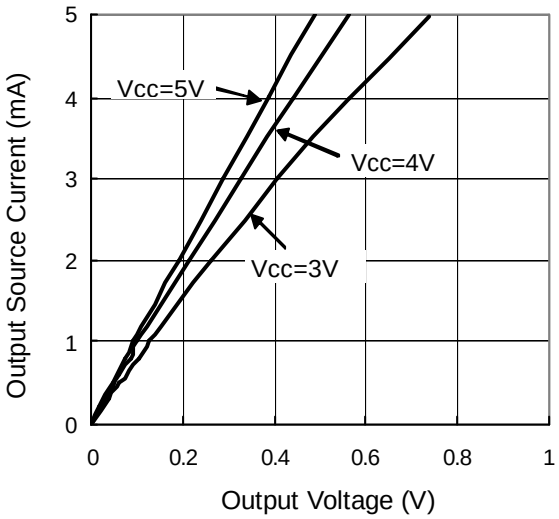
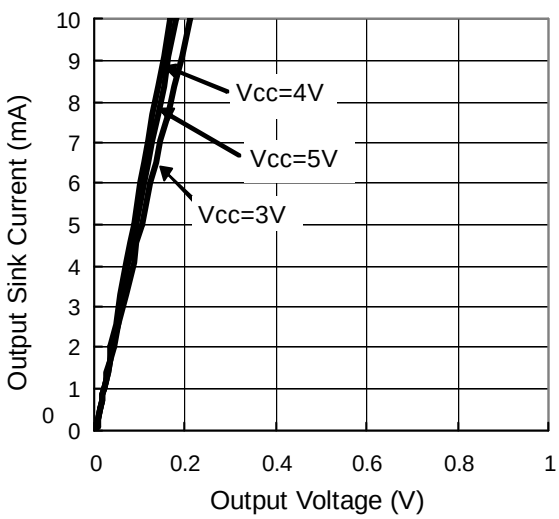
Typical Characteristics

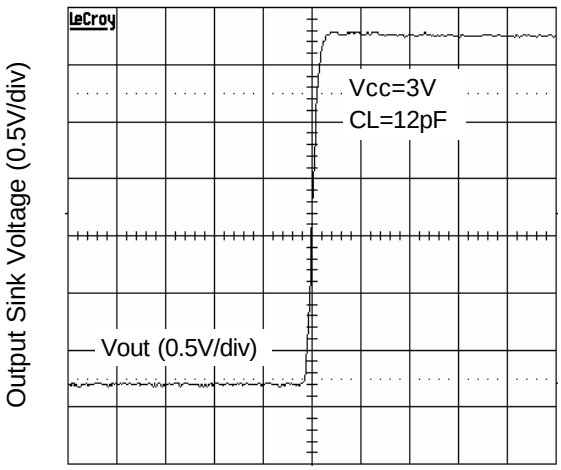
Output Source Current vs. Output Voltage



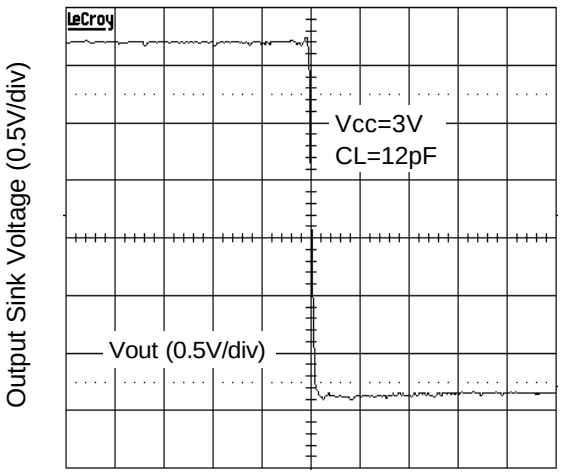
Output Sink Current vs. Output Voltage



Output Switch Waveform



Output Switch Waveform



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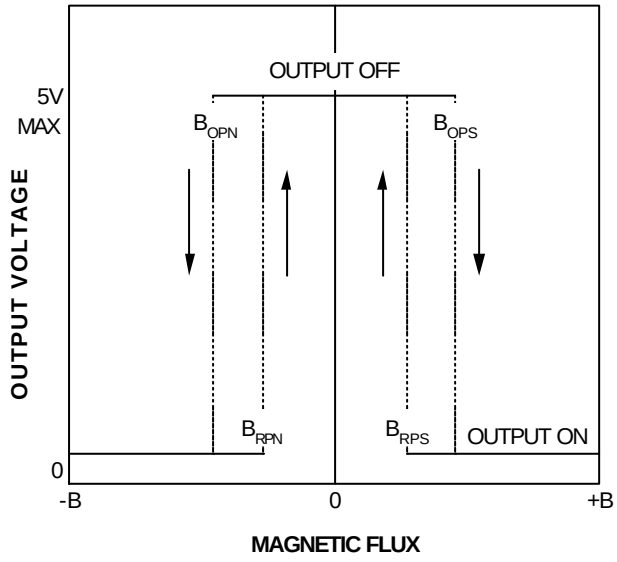
Function Description

Operation

The output of APX9132 switches low (turns on) when in presence of strong flux density facing the marked side of package exceeds the operate point B_{OPS} (or is less than B_{OPN}). After turn-on, the output is capable of sinking up to 1mA and the output voltage is low (turns on). In absence of flux density below the release point B_{RPS} (or increased above B_{RPN}), the APX9132 output switches high (turns off). After turn-off, the output is capable of sourcing up to 1mA and the output voltage is high (turns off). The difference in the magnetic operated and released point is the hysteresis (B_{hys}) of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical bouncing vibration and electrical noise.



Pole-independent

The pole-independent sensing technique allows for operation with either a north or south pole magnet orientation, enhancing the manufacturability of the device. The state-of-the-art technology provides the same output polarity for either pole in presence.

Awake & Sleep

Internal awake & sleep timing block circuit activates the sensor for 180 us and deactivates it for the remainder of the period (60 ms). A short “awake” time allows for stabilization prior to the sensor sampling and data latching on the falling edge of the timing pulse. While in sleep cycle the output is latched in its previous state.

Chopper Stabilized Technique

The chopper stabilized technique cancels the mismatching of the hall element, the amplifier offset voltage and temperature sensitive drift by the dynamic offset cancellation and switched capacitor technique. This technique produces devices have an extremely stable Hall output voltage, therefore the magnetic switch points are stable.

Application Information

It is strongly recommended that an external bypass capacitor be connected (in close to the Hall sensor) between the supply and ground of the device to reduce both external noise and noise generated by the chopper-stabilization technique. This is especially true due to the relatively high impedance of battery supplies.

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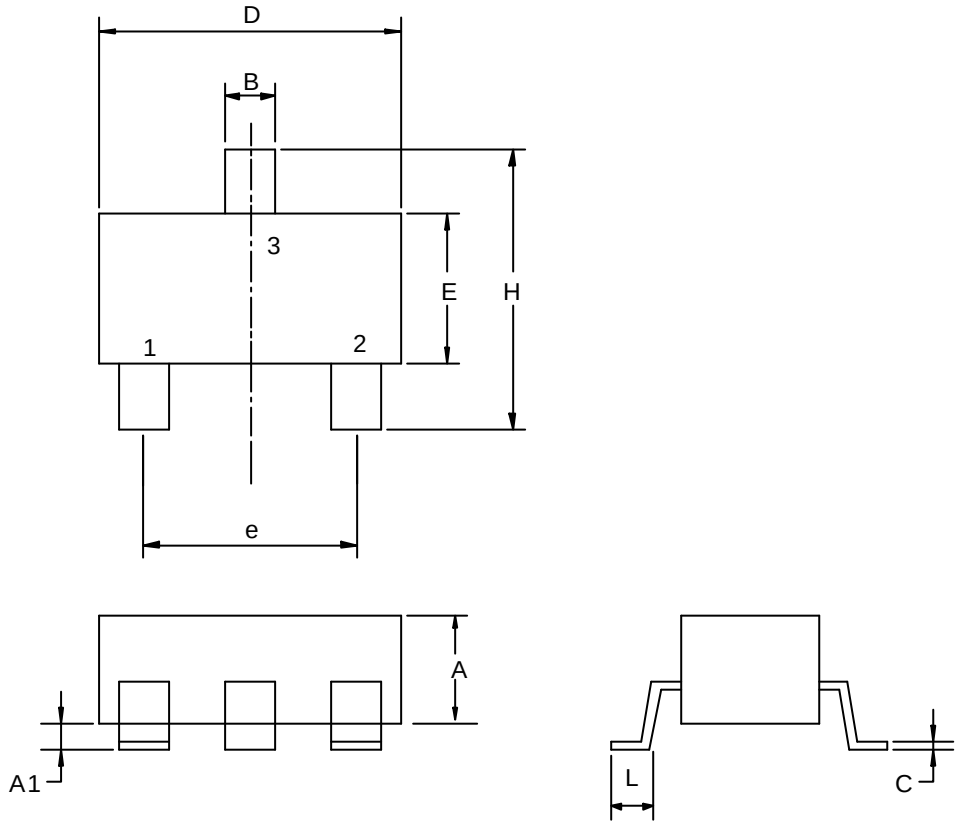
Package Information

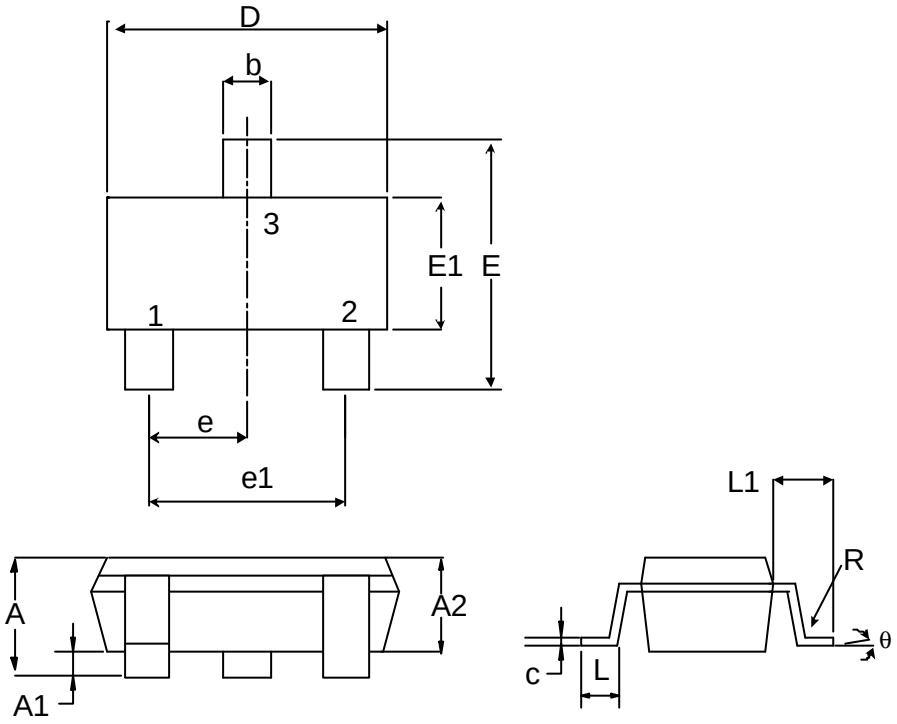
SOT-23



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.00	1.30	0.039	0.051
A1	0.00	0.10	0.000	0.004
B	0.35	0.51	0.014	0.020
C	0.10	0.25	0.004	0.010
D	2.70	3.10	0.106	0.122
E	1.40	1.80	0.055	0.071
e	1.90/2.1 BSC.		0.075/0.083 BSC.	
H	2.40	3.00	0.094	0.118
L	0.37		0.015	

Package Information

SOT-23 Thin



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.75	0.80	0.028	0.031
A1	0.025	0.05	0.001	0.002
A2	0.75	0.775	0.029	0.030
b	0.35	0.51	0.014	0.020
c	0.10	0.20	0.004	0.008
D	2.80	3.00	0.109	0.117
E	2.60	3.00	0.101	0.117
E1	1.50	1.70	0.059	0.066
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.074 BSC	
L	0.37	0.60	0.014	0.023
L1	0.60 REF		0.0234 REF	
R	0.10	-	0.004	-
θ	0°	8°	0°	8°

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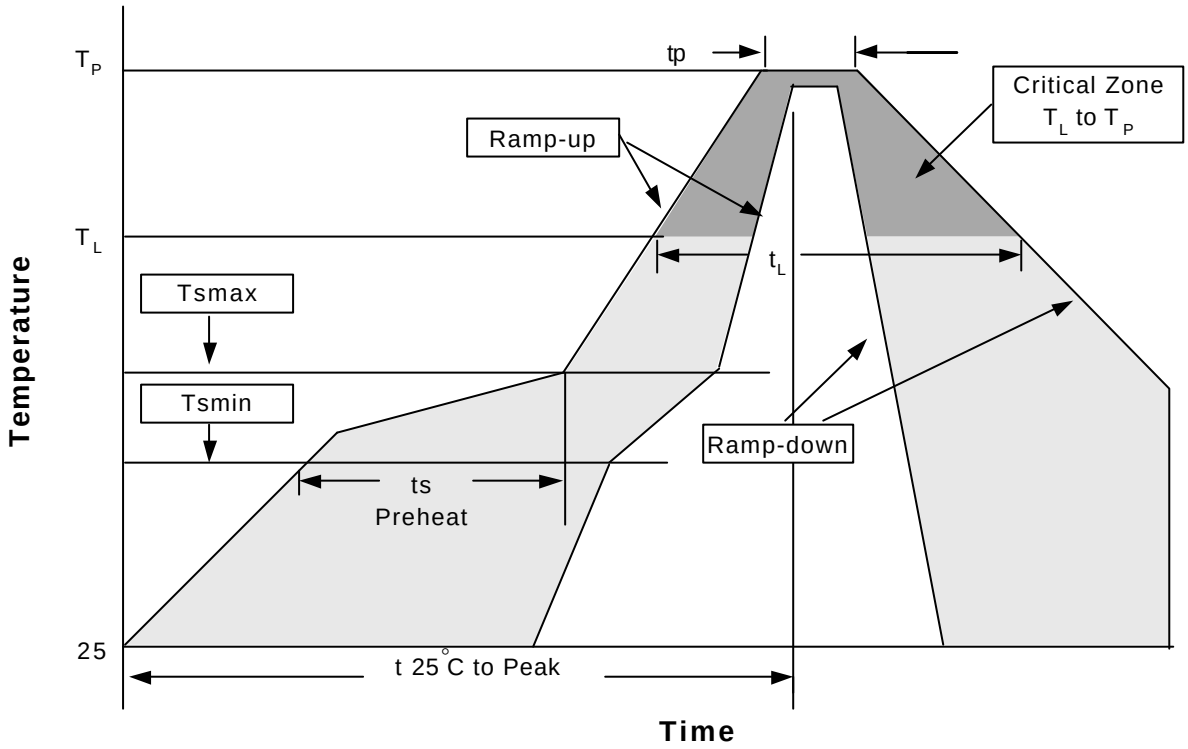
Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.
Packaging	3000 devices per reel

Reflow Condition (IR/Convection or VPR Reflow)



Classificatin Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max.	3°C/second max.
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (min to max) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classificatioon Temperature (Tp)	See table 1	See table 2
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

Notes: All temperatures refer to topside of the package .Measured on the body surface.

Classificatin Reflow Profiles(Cont.)

Table 1. SnPb Entectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 ³350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

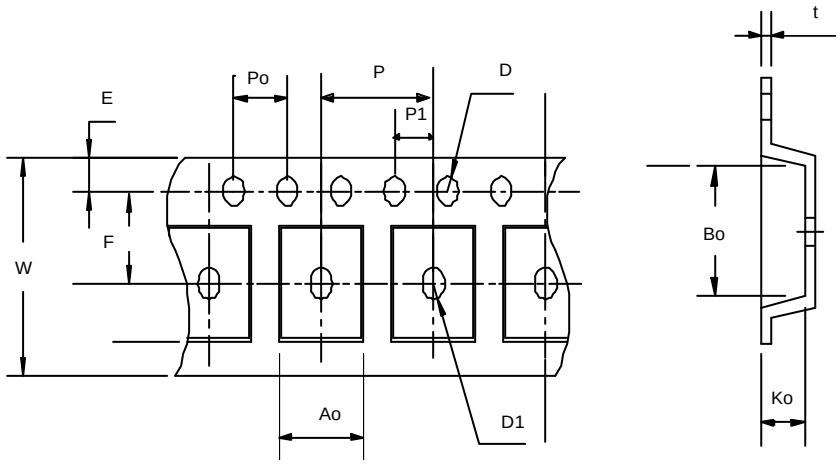
Table 2. Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*
*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.			

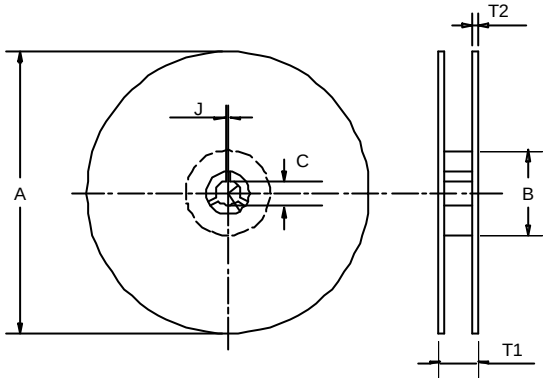
Reliability test program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C , 5 SEC
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @ 125 °C
PCT	JESD-22-B, A102	168 Hrs, 100 % RH , 121°C
TST	MIL-STD-883D-1011.9	-65°C ~ 150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms , I_{tr} > 100mA

Carrier Tape & Reel Dimensions



Carrier Tape & Reel Dimensions(Cont.)



Application	A	B	C	J	T1	T2	W	P	E
SOT-23	178±1	60 ± 1.0	12.0	2.5 ± 0.15	9.0 ± 0.5	1.4	8.0+ 0.3 - 0.3	4.0	1.75
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	3.5 ± 0.05	1.5 +0.1	Φ0.1MIN	4.0	2.0 ± 0.05	3.1	3.0	1.3	0.2±0.03
Application	A	B	C	J	T1	T2	W	P	E
SOT-23 Thin	178±1	60 ± 1.0	12.0	2.5 ± 0.15	9.0 ± 0.5	1.4	8.0+ 0.2	4.0±0.1	1.75±0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	3.5 ± 0.05	ϕ1.55+ 0.05	ϕ 1.1±0.1	4.0±0.1	2.0 ± 0.05	3.3±0.1	3.2±0.1	1.1±0.1	0.25±0.05

(mm)

Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOT- 23	8	5.3	3000
SOT- 23 Thin	8	5.3	3000

(mm)

Customer Service

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